SYSTEM FOR CORRELATING A SUBSCRIBER UNIT WITH A PARTICULAR SUBSCRIBER IN A PASSIVE OPTICAL NETWORK

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Background of the Invention

1. Field of the Invention

The present invention is directed to communications networks and, in particular to a system for configuring subscriber equipment upon installation within a communication network.

2. Background Art

Transmission of data (voice, video and/or data) over fiber optic cabling is becoming common place. For instance, optical transmission is heavily used for long-distance (or inter-LATA) telephone transmission. Where fiber optic communication has been used in local exchanges (sometimes referred to as a Local Access & Transport Area or "LATA") a passive optical network ("PON") has been used. The name PON arises from the use of passive splitters (e.g. star couplers) to distribute signal between the central office (CO) and multiple, spatially distributed subscriber locations via fiber optic cables. PONs are one example of point to multipoint wire line networks.

Point to multipoint wire line networks have various benefits including, but not limited to, the lower equipment costs. These lower equipment costs over traditional point to point networks arise, in part, due to the absence of dedicated lines and ports for each subscriber. However, because there is no unique port (path) linking each subscriber to the network, there is no inherent means for uniquely identifying the downstream path to any particular subscriber. Such a path is required, for instance, to appropriately terminate an incoming voice call for any particular subscriber (e.g. the subscriber at (212) 555-1212). Thus, while the service provider knows the identity of any particular subscriber at installation, a passive optical network does not. Consequently, in order to deliver communications and uniquely desired service to each subscriber, there is a need to establish some correlation between the subscriber's identification and the optical network unit ("ONU") serving that location.

Summary of the Disclosure

A number of technical advances are achieved in the art, by implementation of a method for correlating a subscriber unit to a physical port in a point to multipoint wire line network. The method comprises: (a) prompting an installer to manually input a location code associated with the subscriber; (b) receiving the location code in the subscriber unit; (c) transmitting the location code via the network to a central repository ; and (d) storing the location code in the central repository toward associating the location code with the physical port. In some approaches, storing may further including checking the location code for errors before storing and upon finding an error, transmitting an instruction to the subscriber unit to indicate error to the installer and upon finding no errors, storing the location code. When the installer receives an error indication there may also be a further prompt to reinput the location code.

The method may also include transmitting the site code and storing it in the central repository.

Other systems, methods, features and advantages of the invention will be or will become apparent to one with skill in the art upon examination of the following figures and detailed description. It is intended that all such additional systems, methods, features and advantages be included within this description, be within the scope of the invention, and be protected by the accompanying claims.

Brief Description of the Drawings

The components in the figures are not necessarily to scale, emphasis instead being placed upon illustrating the principals of the invention. Moreover, in the figures, like reference numerals designate corresponding parts throughout the different views.

Fig. 1 of the drawings is a block diagram of one universal demarcation point connected to a passive optical network that has a universal demarcation point associated with each of its plurality of subscribers.

Fig. 2 of the drawings is flow diagram of the method for correlating a optical network unit with the central office.

Detailed Description of the Preferred Embodiments

When a universal demarcation point ("UDP") 50 is installed in a passive optical network ("PON") 40 by installer 20, optical network unit ("ONU") 51 of UDP 50 must be configured to receive and transmit signals correctly over the PON. Configuration of the ONU 51 with the PON facilitates proper communication to occur between installed UDP 50 and its associated optical line termination ("OLT") 52 (shown in Fig. 1 as being located at central office 41). Thus, for instance, configuration may register the serial number of the UDP 50, ONU 51 and even correlate that UDP and ONU with the equipment along the branch by which UDP 50 is operably connected to the PON. However, configuration does not correlate the identity of subscriber 30 (i.e. John Smith) with ONU 51 or even OLT 52. This correlation is important because generally

a PON will include a plurality of subscribers, OLTs and ONUs. Each of these subscribers are operably connected to the central office via a series of fiber optic cables, passive optical splitters, and a specific optical line terminator ("OLT") located at the central office in a "tree structure."

Fig. 1 generally illustrates, among other things, one PON tree topology and particularly one particular branch in the PON tree structure. It would be understood by those of skill in the art having the present specification before them that alternative topologies will also work with the disclosed invention. As illustrated, subscriber 30 is operably connected to central office 41 via OLT 52, fiber optic cable 53, optical splitter 60a, fiber optic cable 54a and UDP 50. Thus, as depicted in Fig. 1, OLT 52 is a conduit to fiber optic cables 54a through 54n (in preferred approach n=32) via optical splitter 60a. Of course, other OLTs in PON 40 will support other branches of the PON via other optical splitters 60b through 60n. As further depicted in Fig. 1, it is contemplated that additional optical splitters (see reference number 61a) will exist in the system even at secondary (and deeper) levels toward supporting even further subscribers on each OLT branch via fiber optic cables 56a through 56n.

Once installer 20 has operably installed UDP 50 on the PON, the configuration may be initiated manually or automatically. Although not relevant to the present invention, it should be understood that communications could be implemented over the PON using a frequency-division, wavelength-division or time-division multiplexing scheme. Thus, for instance, where a time-division multiplexing scheme is used, upon installation (or hard start up) among other possible configuration requirements, ONU 51 must be ranged such that upstream transmissions are inserted by the UDP at the appropriate time onto the PON. For purposes of the present invention, once configuration has completed, the UDP and its ONU can properly communicate with the central office.

Once configuration has been completed, general practice indicates that the installer should verify the receipt of dial tone at the subscriber location. This verification is has generally been performed in all types of telephone networks by operably connecting a butt set (or any other touch tone phone) to the UDP using one of electrical connectors 70. Of course, various types of testing device may be utilized with the present invention as will be apparent in view of the present disclosure. In a preferred approach, installer 20 would connect butt set 21 to the last POTS binding post among the electrical connectors 70 to run this test. While using the last binding post adds some complexity to UDP controller and installer training, it greatly decreases the odds that subscriber 30 will ever pick up a phone set on a line that is in registration mode after a power outage.

In addition to testing for dial tone, the installer 20 may be required to establish the site key for the UDP 50. The site key identifies the customer or UDP 50, which in turn identifies the ONU location and the service parameters associated with the customer or UDP 50. The ONU location is generally the same as the customer location. Where necessary, in a preferred approach, the installer would take the butt set 21 off-hook and enter a "#." In response, the UDP 50 prompts the installer 20 to enter the site key of the location. This prompt may take any form that would be perceivable to the installer 20 including, but not limited to, audible and textual prompts. In the preferred approach using a butt set, audible prompting is most likely. This audio feedback would preferably be generated by ONU 51 – in response to download announcements – using the existing voice processing hardware in the ONU.

The installer 20 enters (via the testing device) the site key. The location site key is a numeric code assigned by the utility company for each UDP in the PON. In a preferred approach, this entry will be accomplished using the touch tone keys on the butt set 21 followed by the pound sign. However, another testing device with other forms of manual entry may also

be used. In response, to the completed entry of the site key, UDP 50 transmits the site key along with the UDP's serial number (stored in non-volatile memory in the UDP (not shown) to the Element Management System (EMS) via the host digital terminal ("HDT").

Now that configuration of the UDP has been completed, correlation can be performed. If the testing device (e.g. butt sett 21) in not already connected to one of the electrical connectors 70 of UDP 50, the installer would operably connect such a device. Alternatively, it is contemplated that the device may be directly connected to the ONU within UDP 50a (the utility company side of the UDP 50) for correlation. Upon connection, correlation would be initiated. In the approach where electrical connectors 70 are utilized by the installer a manual signal, such as a key activation or series of key activations may be required. In the approach where the installer operably connects the testing device directly to the ONU, the connection, itself, may automatically initiate correlation. Other connections may also be programmed to automatically initiate correlation.

In response to correlation initiation, manual feedback unit 100 will provide a user perceivable instruction to enter a location key for the UDP 50 (a unique integer assigned to the location). This user perceivable instruction may take various forms, such text or audio. Where an audio instruction is used the audio may be stored in various formats, such as CD-audio, ".WAV", MP3, PARCOR speech synthesis, etc. In such an approach, UDP 50 will include a media player or speech synthesizer, depending upon the format in which the audio is stored. It is alternatively possible to include an analog tape player to playback an analog tape recording of various phrases.

The installer, in turn, inputs the digits of the location key. This input may be pre-programmed in the installer's testing device or may be entered manually via a keypad on the testing device. In the preferred embodiment, the location key is an integer, which reflects a

customer number already used by the service provider operations support system ("OSS")(e.g. the methods that directly support the daily operation of a LEC) identifying the subscriber 30. More generally, the location code/key is any identifier that can be input via the mechanism provided to the installer that identifies geographic location of the customer. It would be a desirable attribute of the location IDs to be "sparse" so that if the location ID is mis-entered the probability is high that the mis-entered id can be distinguished as a non-valid id rather than the wrong subscriber ID. Where the testing device is a butt set or other telephone-paradigm based device, UDP 50 would be provided with equipment to convert the DTMF tones received into the corresponding digits.

The location key input by the installer 20 is then transmitted to the central office 41. In a preferred embodiment, the location key is placed into an IP package along with the unique identifier for the optical network unit 51 ("ONU"). This IP package is routed over the PON to the OLT 52. In turn, the OLT 52 passes the location key and ONU identifier information to the Element Management System (EMS) 80. It is contemplated that EMS 80 can be provisioned with the remaining pieces of the puzzle so that EMS 80 may correlate the location key with the specific ONU.

The transmitted correlation information will be validated and generally checked for errors. For instance, validation may consider one or more of the following: (1) sufficiency of the information received about the site key; (2) existence of other UDPs on the PON associated with the entered site key; and (3) correct type of the UDP installed at the site. Other potential errors could also be checked as would be understood. This validation may be conducted at any one of various levels, such as the Central Office 41 or the EMS 80.

Once validated, one or more of the OLT 52, central office 41, EMS 80 and/or other EMS modules store the received correlation data. Of course, it would be understood to those of

ordinary skill in the art that the correlation could be stored elsewhere in the central office, such as a central router, which would further correlate the location/UDP codes with a OLT identifier to ensure that the traffic to the subscriber is appropriately routed.

Once the correlation is validated and stored, a message may be transmitted to the UDP 50 with instructions to indicate to the installer either: (1) successful registration or (2) erroneous correlation. In a preferred approach, an "erroneous correlation: indication could be accompanied by commands that cause the UDP to provide directions to the installer 20 on how to handle errors in the ONU Location Correlation process.

The installer would then re-initialize correlation after correcting any errors in installation. In the cases where the installer 20 is unable to successfully correlate the UDP, the installer would have to call into a center to resolve the problem.

At the completion of an installer registering UDP 50, the EMS will have made the correlation between the appearance of UDP 50 on the PON 40 and the site at which the UDP 50 is located (i.e. fiber 54a via splitter 60a, fiber 53 and OLT 52). Thus, the network now has all the information it needs to activate any services that have been pre-provisioned for the site.